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ON THE MAMMALIA OF NORTH GREENLAND AND GRINNELL LAND.*

By H. W. Feilden, F.G.S., C.M.Z.S.

Lepus glacialis.—The Northern Hare was found, though in scanty numbers, along the shores of Grinnell Land, and its footprints were seen on the snow-clad ice of the Polar Sea by Captain Markham and Lieut. Parr, in lat. 83° 10′ N., a distance about twenty miles north of the nearest land. In the autumn of 1875 three or four examples were shot in the neighbourhood of our winter-quarters, lat. 82° 27′ N., and as soon as a glimmer of light enabled us to make out their tracks in the snow we were off in pursuit of them. I find from my journal that on the 14th February, two weeks before the sun reappeared at mid-day, the temperature minus 56°, I was hunting for these animals, and started one from its burrow. This hole was about four feet in length, and scraped horizontally into a snowdrift. I have no doubt the same burrow is regularly occupied, as this one was discoloured by the feet of the animal passing in and out, and a quantity of hair was sticking to the sides; all around the Hare had been scratching up the snow and feeding on *Saxifraga oppositifolia.* Even where exposed by the wind, this hardy plant had delicate green buds showing on the brown withered surface of the last year's growth. The Hare does not tear up this plant by the roots, but nibbles off the minute green shoots. Following a Hare in the twilight with a temperature ninety degrees below the freezing-point may not appear a very desirable occupation, yet my journal, written at the time, records it as a pleasant day, and mentions the glow of light which at meridian marked the south, where the planet Venus was decreasing in brilliancy, and stars of the first magnitude had disappeared at noon, warming the heart with the genial hope of returning sunlight. On the 19th February a Hare was shot by Dr. Moss: it was a male, and weighed nine pounds and a half; and another was obtained on the 20th. I find the following reference to this animal in my note-book of the 18th May, 1876:—"Camp Westward Ho! Valley. Saw two Hares to-day, which I managed to secure: one was a female and contained eight young ones. These Arctic Hares are quaint-looking animals when disturbed. They stand erect on their hind legs, fore feet tucked in close to their bodies, then look around, and if not frightened recommence feeding; if startled they make off in a series of bounds, generally with one fore leg lifted up. This gives their tracks in the snow the appearance of having been made by a three-legged animal." By the end of July the young were nearly as large as their parents, and were pure white, save the tips of the ears, which were mouse-gray, with a small streak of the same colour passing down from the apex of the head to the snout. The adults have the ears tipped with black. The number of young that we found in gravid females varied from seven to eight, which is much in excess of that produced by *Lepus variabilis* in Great Britain, and from which naturalists have found difficulty in separating the Arctic species. Fabricius records the fact of this animal in Greenland having eight young ones. Near Lincoln Bay, in lat. 82° 8′ N., a Hare was shot on the 31st August, 1875, with a very distorted skull, the nasal bones being twisted to the right hand, the incisors of the upper jaw being deflected in the same direction. In the lower jaw only the left incisor was developed, and that protruded in a nearly horizontal direction. This specimen, though in good condition, was small, and weighed only five pounds and a half; another, killed the same day, nine pounds. They were both pure white, with tips of the ear black. We find, therefore, *Lepus glacialis* inhabiting the most northern land yet visited, and attaining its normal weight, eight to ten pounds, under apparently very adverse circumstances. Still I must say it is sparsely diffused, and we found that after killing a pair or two out of each valley that afforded any vegetation, the race seemed to be extirpated in that district, and I imagine it will take several years to restock the area over which we hunted along the northern shore of Grinnell Land. Examples examined by me contained many parasitical worms (*Filaria*) in the large intestine.

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* Concluded from p. 321.

Ovibos moschatus.—The attention of many distinguished naturalists has been given to the history of this animal, but the most important and exhaustive essay on the subject is that by Professor Boyd Dawkins, published in the volume of the Palæontological Society for 1871. There is an excellent article on the Musk-ox in the history of the German Arctic Expedition of 1869-70, and Dr. R. Brown, in his exhaustive paper on the Mammalian Fauna of Greenland, reprinted in the 'Admiralty Manual' of 1875 (from Proc. Zool. Soc.), gives full information in regard to the past and present range of this animal in Greenland. On my return from the Arctic Regions I was able to place in the hands of Dr. James Murie a few small portions of the stomach and other organs, so that before long we shall obtain some further insight into its anatomy from that accomplished physiologist. My regret is that the material given to Dr. Murie was extremely limited in amount. The fossil remains of *Ovibos* found in Siberia, North America, Germany, France and England have been determined by naturalists as identical with the species now found living in the northern regions of the American continent and the most northern and eastern shores of Greenland, whilst most of the larger Mammalia of the Pleistocene period, with which the Musk-ox was associated, have passed away. The Musk-ox, being truly an Arctic mammal, doubtless travelled northward as the glacial ice-cap contracted; but in Europe and Asia this animal found its limit of withdrawal bounded by the mainlands of the Old World. No trace of it has been discovered in Spitzbergen or Franz Joseph Land; and the reasonable conclusion is that the great extent of sea which separates these groups of islands from the continents, formed an insuperable obstacle to its progress in that direction. Doubtless its remains are to be found in the New Siberian Islands, and there is no valid reason why it should not still inhabit Kellett Land. So far as we know, however, the Musk-ox living on the Arctic shores of Asia had no inaccessible retreats analogous to the Parry Archipelago of America, and consequently when brought into collision with man must have quickly disappeared. Towards the close of the last Glacial period, when the Straits of Behring were doubtless as choked with ice as the passage now is between Banks' Land and Melville Island, there could have been no great obstacle to prevent the passage of the Musk-ox from the Old World to the New; but whether its course of migration was from Asia to America, or contrariwise, there can be no question that on the latter continent it found a congenial home. Its remains have been discovered in greater or less quantities from Escholtz Bay on the west to the shores of Lancaster Sound, whilst the animal still inhabits the Barren-lands of the American continent. Even in this wilderness, sparsely inhabited by Eskimo, its southern range is slowly contracting, whilst, according to Richardson, the Mackenzie is now its western limit. Melville Island and other lands to the north of the American continent have proved a safe asylum to the Musk-ox, and there it will continue to propagate its species, undisturbed save by the casual appearance of Arctic voyagers. From the islands of the Parry group its range northwards across the eightieth parallel into Ellesmere and Grinnell Land, as high as the eighty-third parallel to the shores of the Polar Sea, is extremely natural; and Robeson Channel, which has presented no obstacle to the progress of the Lemming and Ermine, has also been crossed by the Musk-ox, the 'Polaris' Expedition as well as ours finding it in Hall Land. After crossing the strait between the American islands, and Greenland, the Musk-ox appears to have followed the coasts both in a northerly and southerly direction, its range in Greenland to the southward being stopped by the great glaciers of Melville Bay. At one time it must have been abundant on the West Greenland coast as far south as the seventy-eighth parallel, for Dr. Kane found numerous remains in the vicinity of Renssellaer Bay, and Dr. Hayes found a skull in Chester Valley at the head of Foulke Fiord. During the single day we explored in the neighbourhood of that locality two skulls were found by members of our Expedition. The destruction of these animals would, I think, rapidly follow on the appearance of the Eskimo at Port Foulke; for I imagine few animals are less fitted to elude the wiles of the hunter. There can be no question that the Musk-oxen found by the Germans on the east coast of Greenland are descendants of those that crossed Robeson Channel, rounded the north of the Greenland continent, and extended their range southward until they met with some physical obstruction that barred their further progress, as has also been the case on the western shore of

Greenland. Dr. Robert Brown, in his 'Essay on the Physical Structure of Greenland,' published by the Geographical Society for the use of the recent Arctic Expedition, thus refers to this range of the Musk-ox, Lemming and Ermine:—"These illustrations, though seemingly trivial in themselves, are yet of extreme zoo-geographical interest as tending to show that the Greenland land must end not far north of latitude 82° or 83°." In the month of August, 1875, we met with abundant traces of the Musk-ox in the Valley of the Twin Glacier, leading inland from the shores of Buchanan Strait. I noticed where these animals had been sheltering themselves under the lee of big boulders, as sheep do on bleak hill-sides, and that the same spots were frequently occupied was shown by the holes tramped out by the animals, and the large quantities of their long soft wool which was scattered around. Musk-oxen were obtained in considerable numbers near to the winter-quarters of the 'Discovery,' over forty being shot; but in the extreme north of Grinnell Land, nearer to the winter-quarters of the 'Alert,' they were much scarcer, only six having been obtained by the crew of that vessel, whilst at Thank God Harbour, where the 'Polaris' Expedition obtained over a score, only one was seen and shot. The range of the Musk-ox in Grinnell Land is confined to the coast line and the valleys debouching thereon. It is an animal by no means fitted to travel through the deep soft snow which blocks up the heads of all these valleys. On one occasion, in Westward Ho! Valley, in the month of May, Lieut. Egerton, R.N., and I came across fresh tracks of this animal in soft snow, through which it had sunk belly-deep, ploughing out a path, and leaving fragments of wool behind in its struggles. Its progression under such circumstances is similar to that of a snow-plough. We noticed that spots on hill-sides where the snow lay only a few inches deep had been selected for feeding grounds, the snow having been pushed away in furrows banked up at the end, as if the head and horns of the animal had been used for the task; a few blades of grass and roots of willow showed on what they had been feeding. The dung of the Musk-ox, though usually dropped in pellets like sheep or deer, is very often undistinguishable from that of the genus *Bos.* No person, however, watching this animal in a state of nature, could fail to see how essentially ovine are its actions. When alarmed they gather together like a flock of sheep herded by a collie dog, and the way in which they pack closely together and follow blindly the vacillating leadership of the old ram is unquestionably sheep-like. When thoroughly frightened they take to the hills, ascending precipitous slopes, and scaling rocks with great agility. How the Musk-ox obtains food during the long Arctic night is very extraordinary; but that it is a resident throughout the year cannot be doubted, as a month after the reappearance of sun-light, in the end of March, and at the very coldest season of the year, we found the fresh traces of these animals in the vicinity of our winter-quarters. I am quite sure that the number of Musk-oxen in Grinnell Land is extremely limited, whilst the means of subsistence can only supply the wants of a fixed number; consequently, after an invasion such as ours, when every animal capable of affording food was ruthlessly but necessarily slaughtered, it must take some years to restock the ground. I lay stress upon this point, because the programme for future American research by Smith Sound contemplates the establishment of colonies at various points, one especially suggested being the winter-quarters of the 'Discovery' in Lady Franklin Sound, and some reference has been made to the abundance of game likely to be obtained there. The cause of the disagreeable odour which frequently taints the flesh of these animals has received no elucidation from my observations. It does not appear to be confined to either sex, or to any particular season of the year; for a young unweaned animal killed at its mother's side, and transferred within an hour to the stew-pans, was as rank and objectionable as any. The flesh of some of these animals of which I have partaken was dark, tender, and as well-flavoured as that of four-year old South-down mutton. Richardson states that the food of the Musk-ox is at one season of the year grass, at another lichen. Leaves and stems of the willow, with grasses, were in the stomachs I examined. This animal is infested with two species of worms, a *Tænia* and a *Filaria*.

Rangifer tarandus.—The Reindeer was not actually met with by our Expedition to the northward of Port Foulke, but its newly-shed horns were found in the Valley of the Twin Glacier, Buchanan Strait. I came across a skeleton recently picked by wolves in the neighbourhood of Radmore Harbour, lat. 80° 27′ N. At various points along the coast of Grinnell Land, further north, we came upon shed antlers, but these may have been of considerable antiquity, whilst Lieutenant Giffard, R.N., found and brought to the ship a portion of an antler which he picked up in lat. 82° 45′ N. It does not appear that the 'Polaris' Expedition observed any trace of the Reindeer in Hall Land, neither was it obtained there by our Expedition.

Phoca hispida.—The Ringed Seal was met with in most of the bays we entered during our passage up and down Smith Sound. It was the only species seen north of Cape Union, and which penetrates into the Polar Sea. Lieutenant Aldrich, R.N., during his autumn sledging in 1875, noticed a single example in a pool of water near Cape Joseph Henry, and a party which I accompanied in September, 1875, secured one in Dumbell Harbour, some miles north of the winter-quarters of the 'Alert': its stomach contained remains of crustaceans and annelids. In June of the following year I observed three or four of these animals on the ice of Dumbell Harbour. They had made holes in the bay ice that had formed in this protected inlet. The Polar pack was at this time of the year still firmly wedged against the shores of Grinnell Land, and so tightly packed in Robeson Channel that no Seal could by any possibility have worked its way into this inlet from outside. I am therefore quite satisfied that *Phoca hispida* is resident throughout the year in the localities mentioned. A female killed on the 23rd August, 1876, weighed sixty-five pounds.

Phoca barbata.—On several occasions while proceeding up Smith Sound I observed this large Seal. We did not see it north of Robeson Channel. Individuals were procured in Discovery Bay, lat. 81° 44′ N., and also at Thank God Harbour, from whence it has been recorded by Dr. Bessels. As previously mentioned, I found the skulls of this animal in the ancient Eskimo settlements of Smith Sound. On the 31st August, 1876, Hans, the Greenlander on board the 'Discovery,' shot one of these Seals in Dobbin Bay. I was informed that it weighed 510 tbs. On taking off its skin an Eskimo harpoon was found buried in the blubber on its back; the socket of the dart was made of ivory, the blade being wrought iron. Hans pronounced it to be a Greenland harpoon-head, and suggested that the animal had been struck in the Danish settlements. *P. grœnlandica* is recorded by Dr. Bessels from Thank God Harbour, but I did not observe it in Smith Sound or northwards.

Trichechus rosmarus.—Kane and Hayes describe the Walrus as very abundant in the vicinity of Port Foulke, and the Eskimo of Etah no doubt capture a great number of them, as many skulls and bones of this animal are strewed about their settlement, which we found deserted in July, 1875. I came across a very well-finished sledge hid in a recess of the rocks near Etah, made entirely of Walrus bones, and shod with runners formed of pieces of the tusk, most carefully adjusted. Curiously enough, we did not see one of these animals in the vicinity of Port Foulke nor in Smith Sound, until we reached Franklin Pierce Bay. There, in the vicinity of Norman Lockyer Island, we saw several Walruses, and killed two or three. Their stomachs contained fragments of *mya* and *saxicava*, and a considerable quantity of a green oily matter. Near Cape Fraser I saw a single Walrus; but as far as my observation goes, it does not proceed further north than the meeting of the Baffin Bay and Polar tides near the above-mentioned Cape.

Balæna mysticetus.—A portion of the rib of a Greenland Whale was found by Lieutenant Egerton, R.N., on the northern shores of Grinnell Land, in lat. 82° 33′ N. It was of great antiquity, but I am unprepared to advance any opinion as to how it got there. I am, however, quite satisfied on one point; and that is—no Whale could inhabit at the present day the frozen sea to the North of Robeson Channel. To penetrate from the north-water of Baffin Bay to Robeson Channel would be a hazardous task for this great animal, and in this opinion the experienced whaling quarter-masters who accompanied our Expedition coincided. We may dismiss from our minds the idea or hope that nearer to the Pole, and beyond the limits of present discovery, there may be haunts in the Polar Sea suitable for the Right Whale. I do not look for the speedy extinction of the Greenland Whale; but it is probable that in a few years the fishing will no longer prove profitable to the fine fleet of whalers that now sail from our northern ports, and I see no hope of Arctic discovery increasing our knowledge of the range of this animal.

Monodon monoceros.—During the month of August, while we were waiting in Payer Harbour, near Cape Sabine, we noticed several Narwhals playing at the edge of the ice, but we saw no more of them after entering the pack of Smith Sound. The range of the Narwhal in that direction is no doubt coincident with the summer extension of the north-water of Baffin Bay. It is not included by Dr. Bessels among the animals of Hall Land. An ancient tusk of the Narwhal was picked up by Lieut. Parr, R.N., on the shore of Grinnell Land, a little above the present sea-level, a few miles to the north of the winter-quarters of the 'Alert.'

THE OSSIFEROUS CAVERNS OF DEVONSHIRE.

By W. Pengelly, F.R.S., F.G.S.*

When, as long ago as 1841, the British Association made its only previous visit to Plymouth, some of us, now amongst its oldest members, thought ourselves too young to take any part in its proceedings. If the effects of that meeting are still traceable in this district, it will be admitted, of course, that the seed then sown was of excellent quality and that it fell on good soil. Be this as it may, the hope may be cherished that thirty-six years will not again be allowed to elapse between two consecutive visits to the capital of the two south-western counties. One effect of this wide hiatus is the loss of almost all the human links whose presence on this occasion would have pleasantly connected the present with the past. A glance at the lists of Trustees and the General, Sectional and Local officers in 1841 will show that the presence of scarcely one of them can be hoped for on this occasion; and there is but little probability that any of those who prepared Reports or Papers for the last Plymouth Meeting will have done so for that which is now assembled.

Nor are these the only changes. In 1841 Section C embraced, as at the beginning, the geographers as well as the geologists; but ten years later the geographers were detached, whether to find room for themselves, or to make room for the students of an older geography, it is not necessary to inquire. Some years afterwards came an innovation which, until entering on the preparation of this Address, I always regarded as a decided improvement. The first Presidential Address to this Section was delivered at Leeds in 1858, by the late Mr. Hopkins, so well known to geologists for his able application of his great mathematical powers to sundry important problems in their science; and from that time to the present, with the exception of the Meetings of 1860 and 1870 only, the President of this Section has delivered an Address.

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* Opening Address as President of Section C. Read at the Meeting of the British Association, Plymouth, August, 1877.

None of the local geological papers read in 1841 appear to have attracted so much attention as those on Lithodomous Perforations, Raised Beaches, Submerged Forests, and Caverns (see 'Athenæum' for 7th to 28th of August, 1841); and, as an effort to connect the present with the past, I have decided upon taking up one of these threads, and devoting the remarks I have now to offer to the History of Cavern-Exploration in Devonshire. I am not unmindful that there were giants in those days; and no one can deplore more than I do our loss of Buckland and De la Beche, amongst many others; nor can I forget the enormous strides opinion has made since 1841, when, in this Section, Dr. Buckland "contended that human remains had never been found under such circumstances as to prove their contemporaneous existence with the Hyænas and Bears of the caverns;" and added that "in Kent's Hole the Celtic knives .... were found in holes *dug by art*, and which had disturbed the floor of the cave and the bones below it" ('Athenæum,' 14th Aug. 1841, p. 626). This scepticism, however, did the good service of inducing cavern explorers to conduct their researches with an accuracy which should place their results, whatever they might prove to be, amongst the undoubted additions to human knowledge.

The principal caverns in South Devon occur in the limestone districts of Plymouth, Yealmpton, Brixham, Torquay, Buckfastleigh, and Chudleigh; but as those in the last two localities have yielded nothing of importance to the anthropologist or the palæontologist, they will not be further noticed on this occasion. In dealing with the others it seems most simple to follow mainly the order of chronology; that is to say, to commence with the cavern which first caught scientific attention, and, having finished all that the time at my disposal will allow me to say about it, but not before, to proceed to the next, in the order thus defined; and so on through the series.

Oreston Caverns.—When Mr. Whidbey engaged to superintend the construction of the Plymouth Breakwater, Sir Joseph Banks, President of the Royal Society, requested him to examine narrowly any caverns he might meet with in the limestone-rock to be quarried at Oreston, near the mouth of the River Plym, not more than two miles from the room in which we are assembled, and have the bones or any other fossil remains that were met with carefully preserved (see Phil. Trans. 1817, pp. 176—182). This request was cheerfully complied with, and Mr. Whidbey had the pleasure of discovering bone-caves in November, 1816, November, 1820, August and November, 1822, and of sending the remains found in them to the Royal Society. It is, perhaps, worthy of remark that, though cavern-researches received a great impulse from the discoveries in Kirkdale, Yorkshire, and especially from Dr. Buckland's well-known and graphic description of them, such researches had originated many years before. The request by Sir Joseph Banks was made at least as early as 1812 (see Trans. Devon. Assoc. v. pp. 252, 253), and a paper on the Oreston discoveries was read to the Royal Society in February, 1817, whereas the Kirkdale Cavern was not discovered until 1821. British cave-hunting appears to have been a science of Devonshire birth. The Oreston Caverns soon attracted a considerable number of able observers; they were visited in 1822 by Dr. Buckland and Mr. Warburton; and in a comparatively short time became the theme of a somewhat voluminous literature. Nothing of importance, however, seems to have been met with from 1822 until 1858, when another cavern, containing a large number of bones, was broken into. Unfortunately there was no one at hand to superintend the exhumation of the specimens; the work was left entirely to the common workmen, and was badly done; many of the remains were dispersed beyond recovery; the matrix in which they were buried was never adequately examined; and we are utterly ignorant, and must for ever remain so, as to whether they did or did not contain indications of human existence. I visited the spot from time to time, and bought up everything to be met with; but other scientific work in another part of the county occupied me too closely to allow more than an occasional visit. The greater part of the specimens I secured were lodged in the British Museum, where they seem to have been forgotten, whilst a few remain in my private collection. Some difference of opinion has existed respecting the character of the successive caverns, and much mystery has been imported into the question of the introduction of their contents. Mr. Whidbey, it is said, "saw no possibility of the cavern of 1816 having had any external communication through the rock in which it was enclosed" (Phil. Trans. 1817, pp. 176—182); but Dr. Buckland was of opinion that they were all at first fissures open at the top, and "that the openings had been long filled up with rubbish, mud, stalactite, or fragments of rock cemented, as sometimes happens, into a breccia as solid as the original rock, and overgrown with grass" (Phil. Trans. 1822, pp. 171—240). The conclusion I arrived at, after studying so much of the roof of the cavern of 1858 as remained intact, was that Dr. Buckland's opinion was fully borne out by the facts; that, in short, the Oreston Caverns were *Fissure Caverns*, not *Tunnel Caverns*. The cavern of 1858 was an almost vertical fissure, extending a length of about 90 feet from N.N.E. to S.S.W. It commenced at about 8 feet below the surface of the plateau, continued thence to the base of the cliff, but how much further was not known, and its ascertained height was about 52 feet. It was 2 feet wide at top, whence it gradually widened to 10 feet at bottom. The roof, judging from that part which had not been destroyed, was a mass of limestone-breccia, made up of large angular fragments, cemented with carbonate of lime, and requiring to be blasted as much as ordinary limestone. The cavern was completely filled with deposits of various kinds. The uppermost 8 feet consisted of loose angular pieces of limestone, none of which exceeded 10 ℔s. in weight, mixed with a comparatively small amount of such sand as is common in dolomitised limestone districts, but without a trace of stalagmite or fossil of any kind. The 32 feet next below were occupied with similar materials, with the addition of a considerable quantity of tough, dark, unctuous clay. Between this mass and the outer wall of the cavern was a nearly vertical plate of stalagmite, usually about 2 feet thick, and containing, at by no means wide intervals, firmly cemented masses of breccia identical in composition with the adjacent bed just mentioned. The bones the cavern yielded were all found within these 32 feet; and were met with equally in the loose and the coherent breccia, as well as in the stalagmite. A somewhat considerable number of ellipsoidal balls of clay, from 1·5 to 2·5 inches in greatest diameter, occurred in the clay of this bone-bed, but not elsewhere. Still lower was a mass of dark, tough, unctuous clay, containing a very few, small, angular stones, but otherwise perfectly homogeneous, and known to be 12 feet deep, but how much more was undetermined. The osseous remains found at Oreston prior to 1858 have been described by Sir E. Home, Mr. Clift, Dr. Buckland, Prof. Owen, Mr. Busk, and others. The animals represented were *Ursus priscus*, *U. spelæus*, Weasel (?), Wolf, Fox, Cave Hyæna, Cave Lion, *Rhinoceros leptorhinus*, *Equus fossilis*, *E. plicidens*, *Asinus fossilis*, *Bison minor*, *Bos longifrons*, and, according to the late Mr. Bellamy, Mammoth and Hippopotamus (see Nat. Hist. of S. Devon, 1839, p. 82). With regard to Hippopotamus, I can only say that I have never met with satisfactory evidence of its occurrence in Devonshire; but the Mammoth was certainly found at Oreston in 1858; and, unless I am greatly in error, remains of *Rhinoceros tichorhinus* were also met with there, and lodged by me in the British Museum. It may be added that the skull and other relics of a Hog were exhumed on that occasion, and now belong to my collection. There was nothing to suggest that the cavern had been the home of the Hyæna; and whilst I fully accept Dr. Buckland's opinion that animals had fallen into the open fissures and there perished, and that the remains had subsequently been washed thence into the lower vaultings" (Reliq. Dil., 2nd ed. 1834, p. 78), I venture to add that some of the animals may have retired thither to die; a few may have been dragged or pursued there by beasts of prey; whilst rains, such as are not quite unknown in Devonshire in the present day, probably washed in some of the bones of such as died near at hand on the adjacent plateau. Nothing appears to have been met with suggestive of human visits.

Kent's Hole.—About a mile due east from Torquay Harbour and half a mile north from Torbay there is a small wooded limestone hill, the eastern side of which is, for the uppermost 30 feet, a vertical cliff, having at its base, and 54 feet apart, two apertures leading into one and the same vast cavity in the interior of the hill, and known as Kent's Hole or Cavern. These openings are about 200 feet above mean sea-level, and from them the hill slopes rapidly to the valley at its foot, at a level of from 60 to 70 feet below. There seems to be neither record nor tradition of the discovery of the cavern. Richardson, in the 8th edition of 'A Tour through the Island of Great Britain,' published in 1778, speaks of it as "perhaps the greatest natural curiosity" of the county; its name occurs on a map dated 1769; it is mentioned in a lease 1659; visitors cut their names and dates on the stalagmite from 1571 down to the present century; judging from numerous objects found on the floor, it was visited by man through mediæval back to pre-Roman times; and, unless the facts exhumed by explorers have been misinterpreted, it was a human home during the era of the Mammoth and his contemporaries. In 1824 Mr. Northmore, of Cleve, near Exeter, was led to make a few diggings in the cavern, and was the first to find fossil bones there. He was soon followed by Mr. (now Sir) W. C. Trevelyan, who not only found bones, but had a plate of them engraved. In 1825, the Rev. J. MacEnery, an Irish Roman Catholic priest residing in the family of Mr. Cary, of Tor Abbey, Torquay, first visited the cavern, when he, too, found teeth and bones, of which he published a plate. Soon after, he made another visit, accompanied by Dr. Buckland, when he had the good fortune to discover a flint implement—the first instance, he tells us, of such a relic being noticed in any cavern (see Trans. Devon Assoc. iii. p. 441). Before the close of 1825 he commenced a series of more or less systematic diggings, and continued them until, and perhaps after, the summer of 1829 (*ibid.* p. 295). Preparations appear to have been made to publish the results of his labours; a prospectus was issued, numerous plates were lithographed, it was generally believed that the MS. was almost ready, and the only thing needed was a list of subscribers sufficient to justify publication, when, alas! on February 18, 1841, before the printer had received any "copy," before even the world of science had accepted his anthropological discoveries—before the value of his labours was known to more than a very few—Mr. MacEnery died at Torquay. After his decease his MS. could not be discovered, and its loss was duly deplored. Nevertheless, it was found after several years, and, having undergone varieties of fortune, became the property of Mr. Vivian, of Torquay, who, having published portions of it in 1859, presented it in 1867 to the Torquay Natural History Society, whose property it still remains. In 1869 I had the pleasure of printing the whole in the 'Transactions' of the Devonshire Association. Whilst Mr. MacEnery was conducting his researches, a few independent diggings, on a less extensive scale, were taken by other gentlemen. The principal of these was Mr. Godwin-Austen, the well-known geologist, whose papers fully bore out all that MacEnery had stated (see Trans. Geol. Soc. Lond., 2nd series, vi. p. 446). In 1846 a sub-committee of the Torquay Natural History Society undertook the careful exploration of very small parts of the cavern, and their Report was entirely confirmatory of the statements of their predecessors—that undoubted flint implements did occur, mixed with the remains of extinct mammals, in the cave-earth, beneath a thick floor of stalagmite. The sceptical position of the authorities in geological science remained unaffected, however, until 1858, when the discovery and systematic exploration of a comparatively small virgin cavern on Windmill Hill, at Brixham, led to a sudden and complete revolution; for it was seen that whatever were the facts elsewhere, there had undoubtedly been found at Brixham flint implements commingled with remains of the Mammoth and his companions, and in such a way as to render it impossible to doubt that man occupied Devonshire before the extinction of the cave mammals. Under the feeling that the statements made by MacEnery and his followers respecting Kent's Hole were perhaps, after all, to be accepted as verities, the British Association, in 1864, appointed a committee to make a complete, systematic and accurate exploration of the cavern, in which it was known that very extensive portions remained entirely intact. This committee commenced its labours on March 28, 1865; it has been reappointed, year after year, with sufficient grants of money, up to the present time; the work has gone on continuously throughout the entire thirteen years; and the result has been, not only a complete confirmation of Mr. MacEnery's statements, but the discovery of far older deposits than he suspected—deposits implying great changes of, at least, local geographical conditions; changes in the fauna of the district; and yielding evidence of men more ancient and far ruder than even those who made the oldest flint tools found in Kent's Hole prior to the appointment of the committee. The cavern consists of a series of chambers and passages, which resolve themselves into two main *divisions*, extending from nearly north to south in parallel lines, but passing into each other near their extremities, and throwing off branches, occasionally of considerable size. The successive deposits, in descending order were—

1st, or uppermost. Fragments of block and limestone from an ounce to upwards of 100 tons weight each, which had fallen from the roof from time to time, and were, in some instances, cemented with carbonate of lime.

2nd. Beneath and between these blocks lay a dark-coloured mud or mould, consisting largely of decayed leaves and other vegetable matter. It was from 3 to 12 inches thick, and known as the ***black mould.*** This occupied the entire eastern division, with the exception of a small chamber in its south-western end only, but was not found in the other, the remoter, parts of the cavern.

3rd. Under this was a stalagmitic floor, commonly of granular texture, and frequently laminated, from less than an inch to fully five feet in thickness, and termed the ***granular stalagmite.***

4th. An almost black layer, about four inches thick, composed mainly of small fragments of charred wood, and distinguished as the *black band*, occupied an area of about 100 square feet, immediately under the granular stalagmite, and, at the nearest point, not more than thirty-two feet from one of the entrances to the cavern. Nothing of the kind has occurred elsewhere.

5th. Immediately under the granular stalagmite and the black band lay a light red clay, containing usually about 50 per cent. of small angular fragments of limestone, and somewhat numerous blocks of the same rock as large as those lying on the black mould. In this deposit, known as the *cave-earth*, many of the stones and bones were, at all depths, invested with thin stalagmitic films. The cave-earth was of unknown depth near the entrances, where its base had never been reached; but in the remoter parts of the cavern it did not usually exceed a foot, and in a few localities it "thinned out" entirely.

6th. Beneath the cave-earth there was usually found a floor of stalagmite having a crystalline texture, and termed on that account the *crystalline stalagmite*. It was commonly thicker than the granular floor, and in one instance but little short of 12 feet.

7th. Below the whole occurred, so far as is at present known, the oldest of the cavern deposits. It was composed of subangular and rounded pieces of dark-red grit, embedded in a sandy paste of the same colour. Small angular fragments of limestone, and investing films of stalagmite, both prevalent in the cave-earth, were extremely rare. Large blocks of limestone were occasionally met with; and the deposit, to which the name of *breccia* were given, was of a depth exceeding that to which the exploration has yet been carried.

Except in a very few small branches, the bottom of the cavern has nowhere been reached. In the cases in which there was no cave-earth, the granular stalagmite rested immediately on the crystalline; and where the crystalline stalagmite was not present the cave-earth and breccia were in direct contact. Large isolated masses of the crystalline stalagmite, as well as concreted lumps of the breccia, were occasionally met with in the cave-earth, thus showing that the older deposits had, in portions of the cavern, been partially broken up, dislodged, and re-deposited. No instance was met with of the incorporation in a lower bed of fragments derived from an upper one. In short, wherever all the deposits were found in one and the same vertical section, the order of superposition was clear and invariable; and elsewhere the succession, though defective, was never transgressed. Excepting the overlying blocks of limestone, of course, all the deposits contained remains of animals, which, however, were not abundant in the stalagmites. The black mould, the uppermost bed, yielded teeth and bones of Man, Dog, Fox, Badger, Brown Bear, *Bos longifrons*, Roedeer, Sheep, Goat, Pig, Hare, Rabbit, and Seal—species still existing, and almost all of them in Devonshire. This has been called the *Ovine* bed, the remains of Sheep being restricted to it. In it were also found numerous flint flakes and "strike-lights," stone spindle-whorls, fragments of curvilineal pieces of slate, amber beads, bone tools, including awls, chisels, and combs; bronze articles, such as rings, a fibula, a spoon, a spear-head, a socketed celt, and a pin; pieces of smelted copper, and a great number and variety of potsherds, including fragments of Samian ware. The granular stalagmite, black band, and cave-earth, taken together as belonging to one and the same biological period, may be termed the *Hyænine* beds, the Cave Hyæna being their most prevalent species, and found in them alone. So far as they have been identified, the remains belong to the Cave Hyæna, *Equus caballus*, *Rhinoceros tichorhinus*, gigantic Irish Deer, *Bos primigeneus*, *Bison priscus*, Red Deer, Mammoth, Badger, Cave Bear, Grizzly Bear, Brown Bear, Cave Lion, Wolf, Fox, Reindeer, Beaver, Glutton, *Machairodus latidens*, and Man—the last being a part of a jaw with teeth, in the granular stalagmite. In the same beds were found unpolished *ovate* and *lanceolate* implements made from *flakes*, not *nodules*, of flint and chert; flint flakes, chips, and "cores;" "whetstones," a "hammer-stone," dead shells of *Pecten*, bits of charcoal and bone tools, including a needle or bodkin having a well-formed eye, a pin, an awl, three harpoons, and a perforated tooth of Badger. The artificial objects, of both bone and stone, were found at all depths in each of the hyænine beds, but were much more numerous below the stalagmite than in it. The relics found in the crystalline stalagmite and the breccia, in some places extremely abundant, were almost exclusively those of Bear, the only exceptions being a very few remains of Cave Lion and Fox. Hence these have been termed the *Ursine* beds. It will be remembered that teeth and bones of Bear were also met with in both the hyænine and the ovine beds; and it should be understood that this biological classification is intended to apply to Kent's Cavern only. The ursine deposits, or rather the breccia, the lowest of them, also yielded evidences of human existence; but they were exclusively tools made from *nodules*, not *flakes*, of flint and chert.

Ansty's-Cove Cavern.—About three furlongs from Kent's Hole towards N.N.E., near the top of the lofty cliff forming the northern boundary of the beautiful Ansty's Cove, Torquay, there is a cavern where, simultaneously with those in Kent's Cavern, Mr. MacEnery conducted some researches, of which he has left a brief account (see Trans. Devon. Assoc. vi. pp. 61—69). I have visited it several times, but it seems to be frequently kept under lock and key, as a tool and powder-house, by the workmen in a neighbouring quarry. It is a simple gallery, and, according to Mr. MacEnery, 63 feet long, from 3 to 9 feet high, and from 3 to 6 feet broad. Beneath some angular stones he found a stalagmitic floor 14 inches thick, and in the deposit below remains of Deer, Horse, Bear, Fox, Hyæna (?), coprolites, a few marine and land shells, one white flint tool with fragments of others, a Roman coin, and potsherds. In a letter to Sir W. C. Trevelyan, dated 16th December, 1825, Dr. Buckland states that Mr. MacEnery had found in this cave "bones of all sorts of beasts, and also flint knives and Roman coins; in short, an open-mouthed cave, which has been inhabited by animals of all kinds, quadruped and biped, in all successive generations, and who have all deposited their exuviæ one upon another" (*ibid.* p. 69).

Yealm-Bridge Cavern.—About the year 1832 the workmen broke into a bone-cavern in Yealm-Bridge Quarry, about one mile from the village of Yealmpton, and eight miles E.S.E. from Plymouth; and through their operations it was so nearly destroyed that but a small arm of it remained in 1835, when it was visited by Mr. J. C. Bellamy, who at once wrote an account of it, from which it appears that, so far as he could learn, the cavern was about 30 feet below the original limestone surface, and was filled to from 1 foot to 6 feet of the roof (see Nat. Hist. S. Devon. 1839, pp. 86—105). In the same year, but subsequently, it was examined by Captain (afterwards Colonel) Mudge, who states that there were originally three openings into the cave, each about 12 feet above the River Yealm; that the deposits were, in descending order:—

1. Loam with bones and stones	3·5 feet
2. Stiff whitish clay	2·5 „
3. Sand	6·0 „
4. Red clay	3·5 „
5. Argillaceous sand	6 to 18·0 „

and that, where they did not reach the roof, deposits were covered with stalagmite. On the authority of Mr. Clift and Prof. Owen, Capt. Mudge mentions relics of Elephant, Rhinoceros, Horse, Ox, Sheep, Hyæna, Dog, Wolf, Fox, Bear, Hare, and Water Vole. The bones, and especially the teeth, of the Hyæna exceeded in number those of all the other animals, though remains of Horse and Ox were very abundant. Mr. Bellamy, whilst also mentioning all the foregoing forms, with the exception of Dog only, adds Deer, Pig, Glutton, Weasel, and Mouse. He also speaks of the abundance of bones and teeth of Hyæna, but seems to regard the Fox as being almost as fully represented; and next in order he places Horse, Deer, Sheep, and Rabbit or Hare; whilst the relics of Elephant, Wolf, Bear, Pig, and Glutton are spoken of as very rare. The bones, he says, were found in the uppermost bed only. They were frequently mere fragments and splinters, some being undoubtedly gnawed, and all had become very adherent through loss of their animal matter. Those of cylindrical form were without their extremities; there was no approach to anatomical juxtaposition; and the remains belonged to individuals of all ages. Reliquiæ of carnivorous animals greatly exceeded those of the Herbivora, and teeth were very abundant. Coprolites occurred at some depth below the stalagmite, in the upper bed, which also contained granitic and trappean pebbles, and lumps of breccia made up of fragments of rock, bones, pebbles, and stalagmite. The bones found prior to 1835 had been removed as rubbish, and some good specimens were recovered from materials employed in making a pathway. Nothing indicating the presence of man appears to have been found.

The Ash-Hole.—On the southern shore of Torbay, midway between the town of Brixham and Berry Head, and about half a mile from each, there is a cavern known as the "Ash-Hole." It was partially explored, probably about, or soon after, the time Mr. MacEnery was engaged in Kent's Hole, by the late Rev. H. F. Lyte, who, unfortunately, does not appear to have left any account of the results. The earliest mention of this cavern I have been able to find is a very brief one in Bellamy's 'Natural History of South Devon,' published in 1839 (p. 14). During the Plymouth Meeting in 1841, Mr. George Bartlett, a native of Brixham, who assisted Mr. Lyte, described in this Section the objects of interest the Ash-Hole had yielded (see Report Brit. Assoc. 1851, Trans.

Sections, p. 61). So far as was then known, the cave was thirty yards long and six yards broad. Below a recent accumulation, four feet deep, of loam and earth, with land and marine shells, bones of the domestic fowl and of man, pottery, and various implements, lay a true cave-earth, abounding in the remains of Elephant. Prof. Owen, who identified, from this lower bed, relics of Badger, Polecat, Stoat, Water Vole, Rabbit, and Reindeer, remarks, that for the first good evidence of the Reindeer in this island he had been indebted to Mr. Bartlett, who stated that the remains were found in this cavern (see Brit. Foss. Mam. 1846, pp. 109-110, 113-114, 116, 204, 212, 479-480). I have made numerous visits to the spot, which, when Mr. Lyte began his diggings, must have been a shaft-like fissure, accessible from the top only. A lateral opening, however, has been quarried into it; there is a narrow tunnel extending westward, in which the deposit is covered with a thick sheet of stalagmite, and where one is tempted to believe that a few weeks' labour might be well invested.

Brixham Cavern.—Early in 1858 an unsuspected cavern was broken into by quarrymen at the north-western angle of Windmill Hill at Brixham, at a point 75 feet above the surface of the street, almost vertically below, and 100 feet above mean tide. On being found to contain bones, a lease in it was secured for the Geological Society of London, who appointed a committee of their members to undertake its exploration; funds were voted by the Royal Society, and supplemented by private subscriptions; the conduct of the investigation was intrusted to Mr. Prestwich and myself; and the work, under my superintendence, as the only resident member of the committee, was begun in July, 1858, and completed at midsummer, 1859. The cavern, comprised within a space of 135 feet from north to south, and 100 from east to west, consisted of a series of tunnel galleries from 6 to 8 feet in greatest depth, and 10 to 14 feet in height, with two small chambers and five external entrances. The deposits, in descending order, were:—

1st, or uppermost. A floor of stalagmite, from a few inches to a foot thick, and continuous over very considerable areas, but not throughout the entire cavern.

2nd. A mass of small angular fragments of limestone, cemented into a firm concrete with carbonate of lime, commenced at the principal entrance, which it completely filled, and whence it extended 34 feet only. It was termed the "first bed."

3rd. A layer of blackish matter, about 12 feet long, and nowhere more than a foot thick, occurred immediately beneath the first bed, and was designated the "second bed."

4th. A red, tenacious, clayey loam, containing a large number of angular and subangular fragments of limestone, varying from very small bits to blocks a ton in weight, made up the "third bed." Pebbles of trap, quartz, and limestone were somewhat prevalent, whilst nodules of brown hematite of iron and blocks of stalagmite were occasionally met with in it. The usual depth of the bed was from 2 to 4 feet, but this was exceeded by 4 or 5 feet in two localities.

5th. The third bed lay immediately on an accumulation of pebbles of quartz, greenstone, grit, and limestone, mixed with small fragments of shale. The depth of this, known as the "fourth" or "gravel bed," was undetermined; for, excepting a few feet only, the limestone bottom was nowhere reached. There is abundant evidence that this bed, as well as a stalagmitic floor which had covered it, had been partially broken up and dislodged before the introduction of the third bed.

Organic remains were found in the stalagmitic floor and in each of the beds beneath it, with the exception of the second only; but as ninety-five per cent. of the whole series occurred in the third, this was not unfrequently termed the "bone bed." The mammals represented in the stalagmite were Bear, Reindeer, *Rhinoceros tichorhinus*, Mammoth, and Cave Lion. The first bed yielded Bear and Fox only. In the third bed were found relics of Mammoth, *Rhinoceros tichorhinus*, Horse, *Bos primigenius*, *B. longifrons*, Red Deer, Reindeer, Roebuck, Cave Lion, Cave Hyæna, Cave Bear, Grizzly Bear, Brown Bear, Fox, Hare, Rabbit, *Lagomys spelæus*, Water Vole, Shrew, Polecat, and Weasel. The only remains met with in the fourth bed were those of Bear, Horse, Ox, and Mammoth. The human industrial remains exhumed in the cavern were flint implements and a hammer-stone, and occurred in the third and fourth beds only. The pieces of flint met with were thirty-six in number. Of these fifteen are held to show evidence of having been artificially worked, in nine the workmanship is rude or doubtful, four have been mislaid, and the remainder are believed not to have been worked at all (see Phil. Trans. vol. 163, 1873, pp. 561, 562). Of the undoubted tools, eleven were found in the third and four in the fourth bed. Two of those yielded by the third bed, found forty feet apart, in two distinct but adjacent galleries, and one a month before the other, proved to be parts of one and same *nodule*-tool; and I have little or no doubt that it had been washed out of the fourth bed and re-deposited in the third. The hammer-stone was a quartzite pebble, found in the upper portion of the fourth bed, and bore distinct marks of the use to which it was applied. Speaking of the discovery of the tools just mentioned, Mr. Prestwich said in 1859:—"It was not until I had myself witnessed the conditions under which flint implements had been found at Brixham, that I became fully impressed with the validity of the doubts thrown upon the previously prevailing opinions with respect to such remains in caves" (Phil. Trans. 1860, p. 280); and according to Sir C. Lyell, writing in 1863:—"A sudden change of opinion was brought about in England respecting the probable co-existence, at a former period, of man and many extinct mammalia, in consequence of the results obtained from the careful exploration of a cave at Brixham. . . . The new views very generally adopted by English geologists had no small influence on the subsequent progress of opinion in France" (Antiquity of Man, pp. 96, 97).

Bench Cavern.—Early in 1861 information was bronght me that an ossiferous cave had just been discovered at Brixham, and, on visiting the spot, I found that, of the limestone quarries worked from time to time in the northern slope of Furzeham Hill, one known as Bench Quarry, about half a mile due north of Windmill Hill Cavern, and almost overhanging Torbay, had been abandoned in 1839, and that work had been recently resumed in it. It appeared that in 1839 the workmen had laid bare the greater part of a vertical dyke, composed of red clayey loam and angular pieces of limestone, forming a coherent wall-like mass, 27 feet high, 12 feet long, 2 feet in greatest thickness, and at its base 123 feet above sea-level. In the face of it lay several fine relics of the ordinary cave mammals, including an entire left lower jaw of *Hyæna spelæa* replete with teeth, but which had nevertheless failed to arrest the attention of the incurious workmen who exposed it, or of any one else. Soon after the resumption of the work in 1861, the remnant of the outer wall of the fissure was removed, and caused the fall of an incoherent part of the dyke, which it had previously supported. Amongst the *débris* the workmen collected some hundreds of specimens of skulls, jaws, teeth, vertebra, portions of antlers, and bones, but no indications of man. Mr. Wolston, the proprietor, sent some of the choicest specimens to the British Museum, and submitted the remainder to Mr. Ayshford Sanford, F.G.S., from whom I learn that the principal portion of them are relics of the Cave Hyæna, from the unborn whelp to very aged animals. With them, however, were remains of Bear, Reindeer, Ox, Hare, *Arvicola ratticeps*, *A. agrestis*, Wolf, Fox, and part of a single maxillary with teeth not distinguishable from those of *Canis isatis*. To this list I may add Rhinoceros, of which Mr. Wolston showed me at least one bone.

From the foregoing undesirably, but unavoidably, brief descriptions, it will be seen that the Devonshire caverns, to which attention has been now directed, belong to two classes—those of Oreston, the Ash-Hole, and Bench being *Fissure Caves;* whilst those of Yealm Bridge, Windmill Hill at Brixham, Kent's Hole, and Ansty's Cove are *Tunnel Caves.*

Windmill Hill and Kent's Hole Caverns have alone been satisfactorily explored; and besides them none have yielded evidence of the contemporaneity of man with the extinct cave mammals.

Oreston is distinguished as the only known British cavern which has yielded remains of *Rhinoceros leptorhinus* (Quart. Journ. Geol. Soc. xxxvi. p. 456).

Yealm Bridge Cavern, if we may accept Mr. Bellamy's identification in 1835, was the first in this country in which relics of Glutton were found (South Devon Monthly Museum, vi. pp. 218—223; see also Nat. Hist. S. Devon., 1839, p. 19). The same species was found in the caves of Somerset and Glamorgan in 1865 (Pleist. Mam., Pal. Soc., pp. xxi., xxii.), in Kent's Hole in 1869 (Rep. Brit. Assoc. 1869, p. 207), and near Plas Heaton, in North Wales, in 1870 (Quart. Journ. Geol. Soc. xxvii. p. 407).

Kent's Hole is the only known British cave which has afforded remains of Beaver (Rep. Brit. Assoc. 1869, p. 208), and up to the present year the only one in which the remains of *Machairodus latidens* had been met with. Indeed Mr. MacEnery's statement, that he found in 1826 five canines and one incisor of this species in the famous Torquay cavern was held by many palæontologists to be so very remarkable as, at least, to approach the incredible, until the Committee now engaged in the exploration exhumed, in 1872, an incisor of the same species, and thereby confirmed the announcement made by their distinguished predecessor nearly half a century before (Rep. Brit. Assoc. 1872, p. 46).

In April last (1877) the Rev. J. M. Mello was able to inform the Geological Society of London that Derbyshire had shared with Devon the honour of having been a home of *Machairodus latidens*, he having found its canine tooth in Robin Hood Cave, in that county, and that there, as in Kent's Hole, it was commingled with remains of the Cave Hyæna and its contemporaries (Abs. Proc. Geol. Soc., No. 334, pp. 3, 4).

The Ash-Hole, as we have already seen, afforded the first good evidence of a British Reindeer.

In looking at the published reports on the two famous Torbay caverns it will be found that they have certain points of resemblance as well as some of dissimilarity:—

1st. The lowest known bed in each is composed of materials which, whilst they differ in the two cases, agree in being such as may have been furnished by the districts adjacent to the cavern-hills respectively, but not by the hills themselves, and must have been deposited prior to the existing local geographical conditions. In each this bed contained flint implements and relics of Bear, but in neither of them those of Hyæna. In short, the *fourth bed* of Windmill Hill Cavern, Brixham, and the *breccia* of Kent's Hole, Torquay, are coeval, and belong to what I have called the *Ursine* period of the latter.

2nd. The beds just mentioned were in each cavern sealed with a sheet of stalagmite, which was partially broken up, and considerable portions of the subjacent beds were dislodged before the introduction of the beds next deposited.

3rd. The great bone bed, both at Brixham and Torquay, consisted of red clayey loam, with a large percentage of angular fragments of limestone; and contained *flake* implements of flint and chert, inosculating with remains of Mammoth, the Tichorhine Rhinoceros, and Hyæna. In fine, the *cave-earth* of Kent's Hole and the *third bed* of Brixham Cavern correspond in their materials, in their osseous contents, and in their flint tools. They both belong to what I have named the *Hyænine* period of the Torquay Cave.

But, as already stated, there are points in which the two caverns differ:—

1st. Whilst Kent's Hole was the home of man, as well as of the contemporary Hyæna during the absences of the human occupant, there is no reason to suppose that either man or any of the lower animals ever did more than make occasional visits to Brixham Cave. The latter contained no flint-chips, no bone-tools, no utilized *Pecten*-shells, no bits of charcoal, and no coprolites of Hyæna, all of which occurred in the cave-earth of Kent's Hole.

2nd. In the Torquay Cave relics of Hyæna were much more abundant in the cave-earth than those of any other species. Taking the teeth alone, of which vast numbers were found, those of the Hyæna amounted to about 30 per cent. of the entire series, notwithstanding the fact that, compared with most of the cave-mammals, his jaws, when furnished completely, possess but few teeth. At Brixham, on the other hand, his relics of all kinds amounted to no more than 8·5 per cent. of all the osseous remains, whilst those of the Bear rose to 53 per cent.

3rd. The entrances of Brixham Cavern were completely filled up and its history suspended not later than the end of the Palæolithic era. Nothing occurred within it from the days when Devonshire was occupied by the Cave and Grizzly Bears, Reindeer, Rhinoceros, Cave Lion, Mammoth, and Man, whose best tools were unpolished flints, until the quarrymen broke into it early in A.D. 1858. Kent's Cavern, on the contrary, seems to have never been closed, never unvisited by man, from the earliest Palæolithic times to our own, with the possible exception of the Neolithic era, of which it cannot be said to have yielded any certain evidence.

Though my "History of Cavern Exploration in Devonshire" is now completed, so far as the time at my disposal will allow, and so far as the materials are at present ripe for the historian, I venture to ask your further indulgence for a few brief moments whilst passing from the region of fact to that of inference.

That the Kent's Hole men of the Hyænine period—to say nothing at present of their predecessors of the Breccia—belonged to the Pleistocene times of the biologist, is seen in the fact that they were contemporary with mammals peculiar to and characteristic of those times. This contemporaneity proves them to have belonged to the *Palæolithic* era of Britain and Western Europe generally, as defined by the archæologist; and this is fully confirmed by their unpolished tools of flint and chert. That they were prior to the deposition of even the oldest part of the peat bogs of Denmark, with their successive layers of beech, pedunculated oak, sessile oak, and Scotch fir, we learn from the facts that even the lowest zone of the bogs has yielded no bones of mammals but those of recent species, and no tools but those of *Neolithic* type; whilst even the granular stalagmite, the uppermost of the Hyænine beds in Kent's Hole, has afforded relics of mammoth, *Rhinoceros tichorhinus*, Cave Bear, and Cave Hyæna.

That the men of the Cave Breccia, or Ursine period, to whom we now turn, were of still higher antiquity, is obvious from the geological position of their industrial remains. That the two races of Troglodytes were separated by a wide interval of time we learn from the sheet of crystalline stalagmite, sometimes 12 feet thick, laid down after the deposition of the breccia had ceased, and before the introduction of the cave-earth had begun, as well as from the entire change in the materials composing the two deposits. But, perhaps, the fact which most emphatically indicates the chronological value of this interval is the difference in the faunas. In the cave-earth, as already stated, the remains of the Hyæna greatly exceed in number those of any other mammal; and it may be added that he is also disclosed by almost every relic of his contemporaries—their jaws have, through his agency, lost their condyles and lower borders; their bones are fractured after a fashion known by experiment to be his; and the splinters into which they are broken are deeply scored with his teeth-marks. His presence is also attested by the abundance of his droppings in every branch of the cavern. In short, Kent's Hole was one of his *homes;* he dragged hither, piecemeal, such animals as he found dead near it; and the well-known habits of his representatives of our day have led us to expect all this from him. When, however, we turn to the breccia, a very different spectacle awaits us. We meet with no trace whatever of his presence, not a single relic of his skeleton, not a bone on which he has operated, not a coprolite to mark as much as a visit. Can it be doubted that had he then occupied our country he would have taken up his abode in our cavern? Need we hesitate to regard this entire absence of all traces of so decided a cave-dweller as a proof that he had not yet made his advent in Britain? Are we not compelled to believe that Man formed part of the Devonshire fauna long before the Hyæna did? Is there any method of escaping the conclusion that between the era of the Breccia and that of the Cave-earth it was possible for the Hyæna to reach Britain?—in other words, that the last continental state of our country occurred during that interval? I confess that, in the present state of the evidence, I see no escape; and that the conclusion thus forced on me compels me to believe also that the earliest men of Kent's Hole were *interglacial*, if not *preglacial*.

OCCASIONAL NOTES.

On the Absence of the Weasel from Ireland.—As no Irish-killed specimen of the true Weasel is to be seen in any of the public Museums, nor any authentic record of its capture in Ireland, it is much to be regretted that Mr. Mahoney, who states in 'The Zoologist' for July (p. 290) that it occurs in Donegal, did not send you a skin, or better still a specimen in the flesh. It is also to be regretted that Mr. Borrer did not shoot the specimen he saw hunting about a stone wall near Currawn, in the Island of Achill, last November. However, it appears to me that both gentlemen may have been mistaken, and that what they took to be Weasels were either young or very small female Stoats, which had either moulted or in some other way lost the black tip of the tail, and thus bore some resemblance to Weasels. The late William Thompson, of Belfast, during the many years in which he was investigating the Natural History of Ireland, never met with the Weasel, nor did he ever receive a specimen from any of his numerous correspondents in nearly every county in Ireland. I well remember asking him if he thought it possible it might yet be discovered as a native, but his reply was that he was very doubtful on the subject. Dr. Carte, who has been for many years Director of the Royal Dublin Society's Museum, never met with a specimen, nor is there one in that Museum. Again, in the South, Dr. Harvey, of Cork, a naturalist of great practical experience, has never met with, nor been able to obtain for his fine collection of our native fauna, an Irish-killed specimen of the Weasel. In a letter which I received from him a few days ago he says:—"I never saw the Weasel in Ireland, and I don't believe we have it. I have had over and over again to prove to people that what they thought to be Weasels were in reality Stoats. So, like yourself, I have still to look for the pleasure of beholding an Irish Weasel." Such being the experience of Thompson in the North, Dr. Carte in the East, and Dr. Harvey in the South of Ireland, there seems very little chance of this animal being found to be a native of Ireland.—Robert Warren (Moyview, Ballina).

British-killed Purple Gallinules.—In 'The Zoologist' for August (p. 339) my friend, the Rev. Murray A. Mathew renews his defence of the Somersetshire and other British-taken Purple Gallinules, *Porphyrio veterum*, against the imputation of being escaped birds and not *bonâ fide* wild visitants to our islands. From my experience of the habits of this species as observed in Spain and Sicily, it seems to me that he is arguing upon erroneous premises, especially as regards its assumed "migratory" instincts. When he says, "Bearing in mind that the birds are migratory, and that the mouth of the Rhone or the coast of Portugal is at no great distance from this country when fairly on the wing," &c., he is doubtless mindful of the exact words of the late M. Favier, and of Colonel Irby, in the 'Ornithology of the Straits of Gibraltar,' but I imagine that both of them use the expression in a far more limited sense than that in which Mr. Mathew has taken it. From the neighbourhood of Gibraltar, where it occurs in January and February, "doubtless on migration" to several marshes where it is resident throughout the year, is but a few miles, and there is a succession of these as far as the great marshes of the Guadalquiver, which are only seventy miles in a straight line from Gibraltar: whilst from the South of Portugal to Bath or Wells it is thirteen degrees of latitude, as the crow flies, or nearly eight hundred geographical miles! Mr. Mathew may consider this "no great distance for a bird when fairly on the wing," but there are birds, and birds, and the Purple Waterhen is one of those most difficult to flush, and settles down as soon as possible after a short flight, seldom, if ever, to be flushed again. If a dog has almost got hold of one, it must perforce rise or be "chopped"; but when, after a short flight, it drops down into the sedge, it runs and clambers amongst the reeds, and is seen no more. It would take twenty couple of otter-hounds to thoroughly rout up a marsh of moderate dimensions so as to give any idea of the Porphyrios it might contain; and after working a couple of those marshes the staunchest pack would be pretty well "baked." Again, it will be observed that even its occurrence "on migration" near Gibraltar is in the months of January and February, the very time at which the officers of the garrison and other sportsmen are in the habit of going out shooting, and consequently many a bird might be seen at that time which at others might pass unnoticed; besides which in winter the cover is not so dense. If the bird were really "migratory," in the usual acceptation of the word, it is strange that it should have become scarce or almost extinct in the marshes of the Albufera of Valencia, in those near Murcia, in those of the Prat and the Almenasa, of the Island of Majorca, and other localities. That it is "more abundant in winter," as Von Homeyer says, merely shows that there are naturally more sportsmen about at that season, and that, the sedge being scantier, it is then more easily obtained. My impression, in fact, is that there are few birds which migrate less and are more locally restricted than this species. Nor can I agree to Mr. Mathew's assumption that any one of the captured specimens was proved to be a wild and genuine migrant because its plumage showed no signs of confinement, for the Purple Gallinule is one of those species which would least show marks of captivity, and to which much greater space and freedom are accorded than to many others. Even were this not the case, I can recall to memory many instances of birds in confinement in perfect plumage; and to cite but one, I may mention a young Golden Eagle taken from the nest on the 4th May, and killed, in default of a purchaser, by one of my Spanish collectors, in September, in which nearly every feather is like satin—a beauty never approached by any wild bird I ever saw, and I think the experience of my friend Mr. E. Hargitt, who now possesses it, will confirm mine. As for escaping from an enclosure, or anything short of an absolute cage, few birds could do so with greater facility, for this Gallinule can climb like a cat, whilst its skulking habits might enable it to remain unnoticed till all traces, if any, of captivity had passed away, and even till the clipped feathers in one wing had been replaced by new ones. To sum up, it seems to me that there are few European species less likely to have come to England of their own accord than the Purple Gallinule; but I will give Mr. Mathew the benefit of a suggestion as to the origin of the individual captured in Somersetshire. It is well known that the Romans kept these birds in captivity: they may have brought some to Britain. Bath was a Roman colony, and the court-yard of some Pro-consul of Æquæ-salis may have been enlivened with the imperial purple hues of this beautiful southern species. When the Roman power waned and "the heathen" poured across the Severn, necessitating those "great battles in the west" of which our Laureate has sung, the neglected Gallinules would naturally seek refuge, and also food (for probably at such times their owners forgot to feed them), in the peaceful marshes of the Parrett. Increase of population and drainage would in later times have diminished their numbers, and in the bird in question we have *perhaps* the last descendant of the original invaders, which, after 1400 years of occupation by its "forbears," may fairly lay claim to naturalization. On this supposition, and on this only, I should be inclined to admit that it has a claim to be considered a "British" bird.—HOWARD SAUNDERS (7, Radnor Place, Hyde Park, W.).

PURPLE GALLINULE IN LANCASHIRE.—Since the discussion in 'The Zoologist,' as to whether it is possible that a Purple Gallinule found at large in this country may or may not be a *bonâ fide* visitor and not an escaped bird, I have made further enquiries with reference to the specimen shot on the 25th September, 1876, at Grange-over-Sands, North Lancashire, to which you allude in the May number of 'The Zoologist' (p. 228). Allan, the gamekeeper, who shot it, tells me that he saw it frequently for a month previously to any attempt on his part to shoot it. Generally it was in company with a large covey of Partridges, feeding on the stubbles, and when disturbed it invariably made for a large bed of reeds. On the first occasion of his seeing it, it ran some distance and then took flight across two fields into this bed of reeds, which is in reality a portion of the deserted channel of the River Winster. On the da [illegible] which it was shot it rose very wild from the reeds (some fifty yards [illegible]), and was brought down by a single pellet through the head. I may add that the *locus in quo* is close to the shore of Morecambe Bay. The bird was most minutely examined both by the birdstuffer and Allan, and they both tell me it presented no signs whatever of confinement, the feathers being sound and glossy and the legs perfectly free from any mark. When I saw the bird it was already stuffed and mounted, so that I could form no opinion of my own on the point.—Edward T. Baldwin (Woodcroft, Ulverston).

Birds observed in Glen Spean.—The Golden Eagle breeds on Ben Aonoch More, the next mountain east of Ben Nevis, and but 400 feet lower. From Ben e Bhean (pronounced "Vahn"), a few feet lower and still more east, I have watched the magnificent flight of this king of birds, and have seen it wheel round over my head so near that I could distinguish its eye, then glide away in a straight line till lost to sight, without apparently moving a feather, but seeming to go at will on outstretched pinions in any direction it chose. On the latter mountain I have seen several pairs of Snow Buntings, *Plectrophanes nivalis*, in July, and listened to their song whilst smoking a pipe, in company with Mr. Howard Birchall, at the foot of the cairn on the summit, near which is a vast heap of quartz-stones of all sizes and shapes, and bad to walk on, which—but for the impossibility of the thing—have the appearance of having been dropped from carts over some acres of nearly level table-land. Amongst these stones, no doubt, these pretty birds breed, but I did not succeed in finding their nests. At the foot of this mountain, near the River Spean, the Woodcock breeds. Ptarmigan frequent the stony parts on all these mountains, and Red Grouse abound in the moors. Below Roy Bridge Black Grouse are plentiful on the south side of the river. In the low, wooded and cultivated parts of the valley the Blackbird, Song Thrush, Cuckoo, Chaffinch, Yellow Bunting, House Martin, Sky Lark, Titlark (*Anthus pratensis*), Rock Pipit, and Redstart are to be met with. On the banks of the streams that feed the Spean numbers of Common Sandpipers breed. On the marshy ground near the river the Redshank and Snipe, and on the banks of the river many pairs of Oyster-catchers also breed; and last year, on a gravel-bed in the middle of the river, twenty-three miles from the sea, I took a nest containing three eggs of the Herring Gull, *Larus argentatus*. I ascertained with certainty that there was no mistake about this, by the aid of a telescope, as the pair of birds stood on the sand at the side of the river, a few hundred yards from the nest. On islands in Loch Laggan, as well as sometimes on the shore of the Loch, the Common Gull breeds. I took about a score of eggs and a pair of young birds of this species last summer on one small island. The Redbreasted Merganser and the Wild Duck also nest on the shores of the Loch. On the moors I have seen the Golden Plover, Peewit, Curlew, Dunlin, and in rocky places the Ring Ouzel, which breeds here, making its nest sometimes on the ground, as does the Blackbird. On all the mountain streams the Dipper is numerous, and on the ridges of Oreag Meaghaidh (pronounced "Maige") I last year saw a Dotterel, *Charadrius morinellus*, with young ones, one of which I caught, but it was so extremely beautiful that I could not find it in my heart to kill it, although a specimen would have been worth securing. The first time I ascended this grand mountain (about 3700 feet above the sea), on the summit, a Sea Eagle, *Haliaëtus albicilla*, flew past me, and in following to see where it went I found the most remarkable rock I know of, where the nest then was; but two or three years since some one shot the female bird, and since then there has been no nest. The rock is, at a guess, 1000 feet high, rising from the bottom of the gorge called Corry Arder, 100 feet wide at the part joining the mountain and 30 feet wide at the part farthest from the mountain. It juts out into the gorge perhaps 500 feet. A more secure place for an Eagle's eyrie could scarcely be found. A little to the west of it is a rock face, about the same height, and a quarter of a mile long, nearly perpendicular, which forms the head of the corry, and between these rocks the snow drifts to a great depth, and the stream from the top finds its way down to Loch Arder under the snow, forming an archway down which a man may creep to the bottom. At the base of the rock is Loch Arder, a small lake swarming with trout. My son and I one day caught six dozen with artificial flies in about two hours, pulling them out frequently three at a time. Between this mountain and Ben Tulloch runs a stream called the Altooma, in which the Dipper delights to sport, and before it reaches the coach-road from Fort William to Kingussie it makes three magnificent falls, the lower one being nearly equal in beauty to the celebrated falls of Foyers. These wonders are not mentioned in any guide-book, and few if any tourists ever visit them. The Raven and the Hooded Crow breed on Oreag Meaghaidh, and the Heron may be seen on all the lakes in and near the Glen. Having spent only two or three weeks each summer for several years in this Glen since 1866, I may not have noticed all the birds that frequent it, but the absence of the House Sparrow is very remarkable. I feel sure a species of Owl lives near my sugaring-ground, for several times when out moth-hunting my hair has been made to stand on end by an unearthly noise which nothing but an Owl could have made.—NICHOLAS COOKE (Gorsey Hey, Liscard, near Birkenhead).

OCCURRENCE OF THE STOCK DOVE IN IRELAND.—I have to report the occurrence here of the Stock Dove, a bird of this year beginning its first moult having been shot here,—on the borders of Armagh and Louth,—on the 12th August. I saw a pair of these birds here last summer. They were nesting in the crevice of a rock on a hill-side covered with heath, at an elevation of about 800 feet above sea-level, and brought out their young. The keeper had observed a pair of pigeons every year in the same quarter, breeding, and reported them to me, but until now did not succeed in shooting a specimen, and neither he nor I could get near enough to determine whether they were Blue Rocks or Stock Doves. Taking this report in connection with the first known occurrence of the species in Ireland in October, 1875, in the County of Down, which I had the honour to report to 'The Zoologist' soon after (February, 1876, p. 4798), and with another in the same county last June, which I believe Mr. Darragh, of Belfast, has already communicated to you, it does appear probable that the extension of the Stock Dove northward in England within the last ten years, as chronicled in the columns of 'The Zoologist,' has led to its further extension across the narrow channel, to the north-eastern parts of this island.—Clermont (Ravensdale Park, Newry).

[The occurrence of the Stock Dove in Ireland is very noteworthy, as until within the last three years it was quite unknown there. A specimen was shot last year in the Co. Down, and presented by Mr. A. O'D. Taylor to the Belfast Museum. During the present summer, as we learn from Mr. Darragh, a pair bred near Comber, in the same county, and a young one, shot after it had left the nest, was obtained by him also for the Belfast Museum.—Ed.]

Imitative Powers of the Whinchat.—On the 15th May last, as my brother and I were taking a walk in the fields near Wilsden, we observed a Whinchat, *Saxicola rubetra*, fly from a wall into an oak tree a little in advance of us. When within about forty yards from the tree we sat down, and my brother called my attention to its singing. To my surprise, it was imitating the song of other birds. During the short time we listened, it imitated in quick succession the song of the Wren, Song Thrush, Chaffinch, Corn Bunting, Tree Lark, Greenfinch, and Starling so successfully that the most practised ear could scarcely have detected the difference. I remarked it again on May 17th; but a swollen stream separating me from the whitethorn in which it was singing, I heard it to great disadvantage. I could hear, however, a few strains which resembled the song of a Linnet, the two shrill call-notes of the Yellow Wagtail, and a note, which it kept repeating, very much after the manner of a Cole Tit. There was no mistake as to the identity of the species in question.—E. P. P. Butterfield (Wilsden, near Bradford).

Ornithological Notes from Dorsetshire.—With reference to the Cormorant of unusual plumage, referred to in 'The Zoologist' for July (p. 280), as seen by Mr. Gatcombe at Wembury, and the same or a similar one by Mr. Clogg on the Cornish coast, I think it probable I saw the bird in Swanage Bay on June 23rd. My attention was attracted to a bird approaching me whose flight resembled that of a Cormorant with a Gannet's plumage; it fortunately passed within fifty yards of me, and I had no difficulty in identifying it. That it was a Cormorant I have no doubt, and corresponded with Mr. Gatcombe's account of the Wembury bird, with this difference—the wings and body appeared to be the normal colour of the species, rather than "silvery gray." The difference might only have been, through optical delusion, caused by reflection, the sky at the time I saw it being clear and unclouded. If it is the same bird, and seen in three successive counties, it must be making a tour of the English coast, and by practical experience finding the most favoured spots to satisfy its voracious appetite. Two colonies of Black-headed Gulls have established themselves on lakes between Poole and Studland. At one of these lakes Pochards have bred for the last three years. In the spring of 1875, a male Pochard, incapacitated from accompanying his companions northwards by a fractured wing, was fortunate enough to induce a female to remain with him, and a brood of young red-heads appeared on the lake, which was so carefully and successfully watched that the following year (1876) three broods were hatched. Having only just returned after a long absence from home, I have been unable to assure myself of the progress made in the further propagation of this bird. My friend Mr. W. M. Calcraft writes me word that a few weeks since he observed a hawk (a Peregrine probably) swoop down upon a Black-headed Gull on the wing, but failing to capture the bird he quickly returned and took it up as it floated on the water, and alighted on the ground a short distance off, with the intention of making a repast on the remains, but on the approach of Mr. Calcraft he flew away, leaving the gull in his possession. Curlews have bred this season on the heaths between Poole and Wareham. An egg of this bird was sent me last April, containing a chick just ready to enter upon subaërial life: its length was four inches; bill, three-quarters of an inch. Choughs and Ravens have returned to their old nesting-places on the rugged coast of Purbeck, after extermination before the passing of the Wild Birds Preservation Acts. The Peregrine breeds in Gadcliff (the noble headland on the western side of the so-called "island"), which is happily so steep and precipitous that no human hand can rob it of its young, although it not unfrequently falls to the gun or trap of the inexorable gamekeeper.—J. C. MANSELL-PLEYDELL (Longthorns, Blandford).

BREEDING OF THE POCHARD AND BLACK-HEADED GULL IN DORSETSHIRE. —In the early part of June, I was informed that there were some curious birds breeding at a pool well known as a favourite resort of wild fowl in this vicinity, and that the keeper had never seen any like them there before. So one fine morning I got on board a sailing-boat, and ran down the harbour to the point of land nearest to the pool. From here a short walk leads one to the brow of a small hill looking out over the waters of the English Channel. The sheet of water I purposed visiting lies between this hill and the sea, separated from it only by a low line of sand-hills, and in one place by a flat plain which in gales of wind is completely inundated. At a glance one could see what a place it naturally is for wild fowl. A wide piece of water in the middle, the south-west end being closed in by a large and very thick reed-bed, the other extremity tapering off into a long series of narrow ponds and bogs,—something like Slapton on a smaller scale, but with the advantage of having a large mud estuary at its back, and of being in a more retired position,—having no roads near it, to say nothing of "Sand Hotels," the only habitations being an old hulk drawn up on the beach for the coast-guard, and a deserted and ruinous cottage which has sheltered many a wild-fowler, with his death-dealing punt-gun and almost invisible punt close by, among the rushes within a few yards of the door. I walked down across the rough heath and furze to the edge of the pond to meet the keeper, who was rowing across in a canoe. Getting in this we started to visit the strange birds. As we went along, I questioned the man as to Ducks, &c., breeding, of which there were plenty, as well as Teal, although I did not see any of the latter. Coots, Moorhens and Dabchicks we saw in numbers; and, what is much more interesting to ornithologists, about thirty Pochards had been hatched out there this year, but the eels or other fish had destroyed the greater part of them. We were now approaching a long outstretching rushy point, which divided off the broad sheet of water from the ponds—a place much appreciated by the Coot-shooter. At the end of this point were several small rushy islands, and these had been selected for the breeding place of a party of Black-headed Gulls; and this bird it was that had puzzled the keeper. He did not think it could be "a Gull, as it was so small and had a black head." I told him not to disturb them, as they would do no injury, and were a great addition to the charm of that lonely sheet of water, which, without its bird-life, would serve one's mind to look back upon as an image of desolation. On returning from the Gulls' nests, one of which contained a young bird—the colony consisting of about seven pairs—I expressed a desire to see the young Pochards. The keeper said there were little lots of them in several places, and that one in particular used a small pool called the "little black pool" at the extreme end of the pond. We paddled slowly up through the winding rush-bordered lanes of water connecting the ponds, through the "big black pool," much loved by the Pochards in winter for its abundance of weed. Here it was that some years ago above eighty of these birds were killed by the discharge of two punt-guns, one fired at them on the water, the other just as they were getting on wing—the best chance for killing this sort of bird, as their feathers are then more open, and they give plenty of time while "skittering" before they can get their plump bodies well into the air. At the end of the little black pool, I discovered the birds we were in search of. They seemed not the least alarmed at our presence, being, I suppose, accustomed to the keeper's boat. They swam rapidly along within ten yards of us, the old bird and three young. There had been five, but something had destroyed them; the keeper blamed the big eels, of which there are quantities in the pond. I left the man here, landing close by the old cottage, and walked across the heath down towards the harbour. About thirty Curlews got up from the top of the hill as I came up over the brow. The keeper had previously informed me of their breeding in the vicinity of the pond. As I got within a quarter of a mile of the beach my attention was attracted by some small white object running rapidly along the turf, which had been cut for peat. I soon made it out to be a Ringed Plover, and after a little search discovered its four eggs, in a very poor apology for a nest, on the bare turf at least three hundred yards from the water. I came out upon the shore close to a long tongue of gravel, the end of which was absolutely covered with birds, of two kinds only—Herring Gulls and Cormorants. As I approached the Gulls flew off, while the Shags walked slowly into the water, swam across a small creek and waddled out on the mud, with a look of lazy unconcern, which was justified by the extreme heat of the day. A pair of Oystercatchers, with their shrill cries and prettily contrasted plumage, accompanied me on my walk back to the boat, while a handsome-looking Shieldrake, whose nest was probably in one of the numerous rabbit-holes near the beach, flew uneasily round my head, and was no doubt relieved to see the brown sail of our una-boat hoisted to a favourable breeze.—T. M. PIKE (Westport, Wareham).

RING OUZEL NESTING NEAR MALVERN.—This bird has nested on the North Hills this summer, and has succeeded in rearing its young. On two other occasions the Ring Ouzel has nested on the hills, but in both cases a mishap prevented the hatching.—ISAAC HARDING (10, Lansdown Crescent, Malvern).

SCARCITY OF THE CORN CRAKE IN THE WEST OF ENGLAND.—A few years since I wrote to 'The Field' on the almost complete disappearance of the Corn Crake in the West of England, where it used to be one of the commonest of our spring migrants. I was not led to do so from the phenomena of an exceptional season, but from the observation that year by year the Corn Crake was surely deserting us, and many meadows and clover fields which used to be vocal with its familiar "crake, crake" seemed destined to re-echo those sounds of spring no more. At Lundy Island Corn Crakes used to assemble in large numbers in September on their autumnal migration, and afforded good sport for a few days. The Rev. H. G. Heaven tells me that Corn Crakes are now rarely seen on that island. The last place where I came across these birds in any number in the West of England was Dartmoor, and here in August I found them on the very wettest bogs. This year I have not heard the call of the Corn Crake once in West Somerset, and last year I only heard it twice. Probably the increased drainage of land has something to do with the scarcity of the bird. Its favourite food consists of small snails, and if through any cause the supply of these becomes diminished we need not wonder at the birds forsaking localities where they can no longer feed.—MURRAY A. MATHEW (Bishop's Lydeard, Taunton).

MIGRATION OF ROOKS.—In 'The Zoologist' last year appeared some notes from Messrs. Stevenson, Cordeaux, and others on the migratory habits of Rooks (see vol. 1876, pp. 4776, 4837, 5105). Few people, perhaps, are aware that numbers of these birds arrive here from the north for the winter. When fishing and shooting in the North Sea during October, I have often met with large flocks of Rooks on their way to this country. It was seldom that they flew in straggling parties like the Gray Crows; those that were seen singly appearing to have fallen out from the ranks through fatigue. After a gale of wind from the south-west, I have seen several floating dead on the water between twenty and thirty miles off the land. I have also received a few wings from the light-ships off the east coast during the winter months, the birds having fallen disabled on deck after striking the lamps. From never having observed them on their return journey in the spring, or obtained any wings from the light-ships at that period, I am not sure whether they take up their residence in this country or again return to the North of Europe, from whence they appear to be making their way when met with in autumn.—E. T. BOOTH (Dyke Road, Brighton).

CURIOUS NESTING-PLACE FOR A HOUSE SPARROW.—An instance of a singular place chosen by the House Sparrow for nidification has come under my notice this year. The nest is built in a cavity formed by the left arm, and half-encircled by the drapery, of the statue erected in 1870 to the Earl of Carlisle, in that part of the Phœnix Park, Dublin, called the "People's Garden." The combined height of the statue and pedestal is fourteen feet six inches, and the place where the nest is constructed is about twelve or thirteen feet from the ground. It was very amusing to observe the saucy way in which the cock and hen were accustomed to perch on his lordship's robes of state before and after visiting the nest. The head gardener informs me that a pair of House Sparrows began to build in the same place the year after the erection of the statue, and that they have done so regularly every year since. He says that two broods have been successfully reared this year.—WILLIAM W. FLEMYNG (18, Upper Fitzwilliam Street, Dublin).

SQUACCO HERON IN KING'S COUNTY.—We have received for preservation a beautiful specimen of the Squacco Heron, forwarded by Lord Carbery from Castle Bernard, King's County. The bird proved to be a female, and in very good condition, the intestines being loaded with fat. The ovary contained eggs, some of them as large as B B shot. The stomach was filled with the wing-cases of small beetles and the remains of small caterpillars.—Williams & Son (2, Dame Street, Dublin).

[The Squacco Heron is a very rare bird in Ireland. Thompson, in his 'Natural History of Ireland' (vol. ii. p. 158), states that one was shot in Killeagh Bay, near Youghal, in May, 1849, and another, also obtained near Youghal, is preserved in the Royal Dublin Society's Museum. A third, shot at the mouth of the Laune river, County Kerry, on June 10th, 1875, will be found recorded in 'The Zoologist' for February last (p. 57). It is somewhat remarkable that these specimens, as well as a score of others procured in different parts of England, were nearly all obtained in the summer months. As a rule, the grallatorial birds which visit this country but do not breed here, come to us in spring and autumn. The Squacco Heron seems to be an irregular summer visitant.—Ed.]

Odd Materials in a Cormorant's Nest.—Cormorants breed not only on high rocks and cliffs, but also at times on low islands, where their nests are elevated only a few feet above high-water mark. Amongst the sticks and other litter which they make use of for building, I have seen children's whips and spades, a gentleman's light cane, and part of the handle of a parasol, all of which I suppose the birds had picked up floating at sea.—E. T. Booth (Dyke Road, Brighton).

Pied Flycatcher Nesting near Malvern.—This beautiful little bird has been seen in and around Malvern on several occasions during the present summer. A pair nested at the Rhidd, but fell victims to the raids of the village lads. Another pair is evidently intending to nest, and is being closely watched by Mr. Edwards, a local naturalist. With the exception of one in my possession, shot two years since, I am not aware that there has been a recorded appearance of the Pied Flycatcher in this part of Worcestershire before.—Isaac Harding (10, Lansdown Crescent, Malvern).

Bartram's Sandpiper in Somersetshire.—In the collection of birds belonging to Dr. Woodforde, of Amberd House, near Taunton, and chiefly obtained in the county of Somerset, is a very perfect example of Bartram's Sandpiper, which was shot at least thirty years ago on the banks of the River Parret, in the parish of Combwitch. It was shot in one of the winter months, and appears to be in complete winter plumage, being more ashy in its coloration than any other example of this Sandpiper which I have seen. So far as I am aware, this specimen has not hitherto been recorded.—Murray A. Mathew (Bishop's Lydeard, Taunton).

Osprey near Bridlington.—On June 30th an Osprey was captured near here, at a place called Gransmoor, the property of Mr. Robert Medforth. It was found by his keeper caught in a pole-trap by one claw, and was not at all injured. It had been seen for five or six months previously in that neighbourhood hawking about a trout-stream. It is now in confinement, and seems to be doing well.—J. H. Hutchinson (Bridlington).

Habits of the Great Pipe-Fish.—In a glass vase in the east saloon of the Royal Aquarium, Westminster, is a fine brood of the Great Pipe-fish, *Syngnathus acus*, recently developed there, affording a good opportunity for observing a portion of the economy of this curious animal. The parent of these little strangers (the male) was received some weeks ago, and on arrival it was observed to carry ova, which had been previously transferred to its "pouch" by a female, before captivity. How long the ova had been thus carried I am unable to state, but they then appeared to be in an early stage of development, for they visibly enlarged in the pouch, causing it to distend very considerably. As most naturalists know, this curious transference of the eggs from the female to a pouch-like process of the male is a part of the life-history of this species. It has not yet been satisfactorily decided how long the ova are carried by the males, but that it is for some time has been proved in this instance; for the actual separation of the young from the parent occurred at least seven weeks after the arrival of the latter in this Aquarium. I cannot corroborate the statement of some authors that the young, on alarm, return to the pouch of the male for safety. On this occasion the young seemed, immediately after birth, to disperse in any direction over the tank in which they were confined. This being a large one, some of them were at times several yards distant from the parent, which, when touched, simply looked after its own safety, and the young had to take care of themselves. These little *Syngnathi* are now (July 4th) about three weeks old, and are an inch and three-eighths long, having grown double their own length in about fourteen days. They are feeding well upon minute organisms, which they find amongst the vegetation growing in the vase. I have every reason to expect rearing them to maturity, which will be a matter of great interest, for I am right, I believe, in stating that this is the first instance of the development of the young of this species in a public Aquarium.—John T. Carrington, (Naturalist and Curator Royal Aquarium, Westminster).

Long-legged Spider Crab at Penzance.—I have taken in my trammel here a specimen of the Long-legged Spider Crab, *Stenorhynchus phalangium*, having conspicuously the small single bristle at the apex of the eye, noted by Prof. Bell. It is stated by him to be common, but that is not my experience of it in Mount's Bay. I have neither taken nor seen a specimen of it for several years.—Thomas Cornish (Penzance).

Correction of Error.—In the reports of the Linnean Society in our August number a few misprints have accidentally crept in, for which the reporter is not responsible, as no proof for correction was sent him. Adopting the official routine, the printer also added "Secretary" to the writer's signature without warrant, and this unfortunately passed through press, escaping our notice.—Ed.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Entomological Society of London.

August 1, 1877.—J. W. Dunning, Esq., M.A., F.L.S., Vice-President, in the chair.

Mr. Stevens exhibited specimens of *Teretrius picipes* (Fab.), one of the *Histeridæ*, which he had taken on the same fence, at Norwood, on which he had previously taken *Tillus unifasciatus*. He also remarked on the appearance in his neighbourhood of a second brood of *Colias Edusa*, several specimens having been observed by him, all of which were males.

Mr. Smith exhibited, on behalf of Dr. Bennett, of Sydney, who was present at the meeting, a fine pair of the beautiful and rare beetle *Eupholus Bennettii* (Gestro), from Yule Island, New Guinea. It had been described under that name in the 'Annali di Museo Civico di Genova,' viii. 1876.

The Secretary exhibited a specimen of an insect which had been forwarded to him by Mr. Bewicke Blackburn, who stated that a large field of mangolds belonging to the Knight of Kerry, in the Island of Valentia, had been totally destroyed by it. The specimen was examined by several of the members, who agreed that it was the larva of a Coleopterous insect, but in consequence of its imperfect condition it could not be determined.

Mr. Douglas, who was unable to be present at the meeting, had forwarded to Mr. Jenner Weir a letter he had received from Mr. R. A. Ogilvie, enclosing specimens of an insect found in great quantities in a jar of pickles (piccalilly). They confined their attacks to the pieces of cauliflower in the jar, which they appeared to relish, notwithstanding the vinegar, mustard, pepper, &c., in the pickles. The specimens had been submitted to Professor Westwood, who replied that "the flies were the common *Drosophila cellaris*, with their curious two-horned pupæ; and they frequent cellars and cupboards, delighting in stale beer, wine, &c." He supposed that "the cauliflowers were more to their taste than the other things in the jar, being more succulent and flabby." In answer to a question put by Mr. Ogilvie, he said that the eggs were laid in the pickle-jar, and not in the vegetables before they were pickled.

Mr. Douglas also forwarded a letter he had received from Mr. A. H. Swinton, of Guildford, enclosing a specimen of *Myrmica ruginodis*, which, on being placed under a wine-glass, stationed itself at the rim, head downwards, and rapidly vibrating the abdomen, continued "an intense noise," resembling the spiracular piping of the Dipteron, *Syrilla pipiens*.

Mr. Enock remarked, with reference to a spider which had been exhibited by Sir Sidney Saunders at a previous meeting as *Atypus Sulzeri*, that he had taken the specimen himself at Hampstead, and that he had since referred it to the Rev. O. Pickard-Cambridge, who stated that the insect was certainly not *A. Sulzeri*, but that he considered it to be *A. Beckii* (Cambridge), which would probably be found to be the same as *A. piceus* (Thorell), though he was not certain, as the only female which he had of that species was too much damaged to admit of any satisfactory comparison. The type of *A. Beckii* was an adult male given to him by the late Richard Beck, who was uncertain of the locality, though Mr. Cambridge appeared to think it probable that he had got it from Hampstead, as he often collected there. The example sent to him by Mr. Enock was different from the Isle of Wight species, of which he had several female specimens, but no males, though he believed them to be *A. Sulzeri*. He would be very glad if collectors in the Hampstead locality would look out for the males in the autumn and winter, as if he could obtain that sex it would enable him to put the question, as to species, at rest.

Mr. Enock exhibited a bottle containing a great number of larvæ of *Cossus ligniperda*, which he had found in a portion of a small willow. He had taken fifty-six larvæ out of a piece of wood four feet long.

Mr. Dunning again directed the attention of members to the exhibition by Mr. Jenner Weir, at the last meeting, of a female specimen of *Cicada montana*, which was reported to have been distinctly heard to stridulate, notwithstanding that the insect was a female, and also that the species was one of which even the males were not previously known to stridulate. Mr. Weir stated that since the last meeting he had again been to the New Forest, and had seen, in the possession of Mr. James Gulliver, of Ramnor, near Brockenhurst, two specimens of *Cicada montana*, and he was assured by Mr. Gulliver that the stridulation of the insect was well known to him, and that he was guided by the sound so made in effecting the capture. Mr. Champion said that he himself had captured the insect, and had distinctly heard a loud buzzing noise, but whether the sound was caused by the males or females he could not say. Mr. Dunning considered that further evidence was wanting to prove stridulation in the females.

A paper was read by Mr. W. F. Kirby, entitled "Notes on the new or rare *Sphingidæ* in the Museum of the Royal Dublin Society; with remarks on Mr. Butler's recent Revision of the Family."

Papers were also communicated, by Mr. J. S. Baly, on "Descriptions of new Genera and Species of *Cryptocephalidæ*," and by the Rev. H. S. Gorham—"Descriptions of new Species of *Cleridæ*."